Hyung-Jin Yoon

Mechanical Engineering, University of Nevada, Reno
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Research Interests

Integration of Machine Learning and Control, Aerial Robotics, Autonomous Vehicle, Cyber Physical System, Mechatronics, Sampling Based Optimal Control.

Academic Background

Ph.D. Mechanical Engineering — 2019
University of Illinois at Urbana-Champaign, IL, USA
- Ph.D. research under direction of Prof. Naira Hovakimyan.
  Dissertation title: Path Planning and Control of Flying Robots with Account of Humans' Safety Perception.

M.S. Applied Mathematics — 2019
University of Illinois at Urbana-Champaign, IL, USA

M.S. Electric and Electronic Engineering — 2013
Sungkyunkwan University, Seoul, South Korea

B.S. Mechanical Engineering — 2006
Hanyang University, Seoul, South Korea

Research Experience

Postdoctoral Researcher — 2020 - Present
University of Nevada, Reno, NV, USA
- Develop control, planning and learning algorithms with applications to autonomous vehicles.
- Support proposal writing.

Postdoctoral Researcher — 2019 - 2020
Media Lab, Massachusetts Institute of Technology, MA, USA
- Application of reinforcement learning for healthcare industry.
- Support proposal writing.

Graduate Research/Teaching Assistant — 1/2014 - 5/2019
University of Illinois at Urbana-Champaign, IL, USA
- Developed virtual reality (VR) testing environment to text human's safety perception of a UAV
- Developed optimal trajectory generation of the UAV using an identified the safety perception model.

Industry Experience

Data Analytics Intern — 5/2018 - 8/2018
Caterpillar, Campaign, IL, USA
- Implementation of reinforcement learning to heavy equipment operations.

Research Engineer — 8/2006 - 8/2013
Hyundai Motor Company, Seoul, South Korea
- Developed electric car energy consumption simulation and tuning gain scheduling map of the prototype cars.

Teaching Experience

Mechanical Engineering in University of Nevada, Reno
Main instructor of the following courses:

- ME 410.1001 Introduction to System Control (Spring 2021)
- ME 310.4001 System Analysis and Design (Summer 2022/2021/2020)

Grant Activity (Not PI or Co-PI)

NSF, Civil, Mechanical and Manufacturing Innovation (CMMI), "Towards Attack-Resilient Vision-Guided Unmanned Aerial Vehicles: An Observability Analysis Approach." P. Voulgaris (PI). Total Award Amount: $274,354, awarded in 2022

- Wrote the content related to adversarial machine learning and reinforcement learning.

NASA, UNIVERSITY LEADERSHIP INITIATIVE (ULI), "Robust and Resilient Autonomy for Advanced Air Mobility." N. Hovakimyan (PI), awarded in 2022

- Wrote the content related to integration and testing utilizing photo realistic simulation environments.

Publications

1. **Hyung-Jin Yoon**, Christopher Widdowson, Thiago Marinho, Ranxiao Frances Wang, and Naira Hovakimyan, "**Socially-Aware Path Planning for a Flying Robot in Close Proximity of Humans**," *ACM Transactions on Cyber-Physical Systems.*
2. **Hyung-Jin Yoon**, Donghwan Lee, and Naira Hovakimyan, "**Hidden Markov Model Estimation-based Q-learning for Partially Observable Markov Decision Process**," *IEEE American Control Conference (IEEE ACC2019).*
3. **Hyung-Jin Yoon**, Christopher Widdowson, Thiago Marinho, Ranxiao Frances Wang, and Naira Hovakimyan, "**A Path Planning Framework for a Flying Robot in Close Proximity of Humans**," *IEEE American Control Conference (IEEE ACC2019).*
4. **Hyung-Jin Yoon**, Huaiyu Chen, Kehan Long, Heling Zhang, Donghwan Lee, Aditya Gahlawat, and Naira Hovakimyan, "**Learning to Communicate: A Machine Learning Framework for Heterogeneous Multi-Agent Robotic Systems**," *AIAA Intelligent Systems Conference*, January 7-11, San Diego, CA, USA. 2019.
5. Donghwan Lee, **Hyung-Jin Yoon**, and Naira Hovakimyan, "**Primal-Dual Algorithm for Distributed Reinforcement Learning: Distributed GTD2**," *IEEE Conference on Decision and Control (2018 CDC)*, December 17-19, Miami Beach, FL, USA.
6. Christopher Widdowson, **Hyung-Jin Yoon**, Venanzio Cichella, Ranxiao Frances Wang, and Naira Hovakimyan, "**VR environment for the study of collocated interaction between small UAVs and humans**," *AHFE 2017 International Conference on Human Factors in Robots and Unmanned Systems, 2017.*
7. **Hyung-Jin Yoon**, Venanzio Cichella, and Naira Hovakimyan, "**Robust Adaptive Control Allocation for an Octocopter under Actuator Faults**," *AIAA Guidance, Navigation, and Control Conference. 2016.*
8. **Hyung-Jin Yoon**, Wenbin Wan, Hunmin Kim, Naira Hovakimyan, Lui Sha, Petros Voulgaris, "**Towards Resilient UAV: Escape Time in GPS Denied Environment with Sensor Drift**," *IFAC Symposium on Automatic Control in Aerospace (IFAC ACA2019).*
9. **Hyung-Jin Yoon**, Hunmin Kim, Kripash Shrestha, Naira Hovakimyan, Petros Voulgaris, "**Estimation and Planning of Exploration Over Grid Map**

Using A Spatiotemporal Model with Incomplete State Observations ," *IEEE Conference on Control Technology and Applications (IEEE CCTA 2021)*

10. Hunmin Kim, **Hyung-Jin Yoon**, Wenbin Wan, Naira Hovakimyan, Lui Sha, and Petros Voulgaris, "**Backup plan constrained model predictive control** ," *IEEE Conference on Decision and Control (2021 CDC)*
11. Hyungsoo Kang, **Hyung-Jin Yoon**, Venanzio Cichella, Naira Hovakimyan, Petros Voulgaris, "**Time Coordination of Multiple UAVs over Switching Communication Networks with Digraph Topologies** ," *IEEE Conference on Decision and Control (2021 CDC)*
12. **Hyung-Jin Yoon**, Chuyuan Tao, Hunmin Kim, Naira Hovakimyan, Petros Voulgaris, "**Sampling Complexity of Path Integral Methods for Trajectory Optimization** ," *IEEE American Control Conference (2022 ACC)*
13. Chuyuan Tao, Hunmin Kim, **Hyung-Jin Yoon**, Naira Hovakimyan, Petros Voulgaris, "**Control Barrier Function Augmentation in Sampling-based Control Algorithm for Sample Efficiency** ," *IEEE American Control Conference (2022 ACC)*
14. Chuyuan Tao, **Hyung-Jin Yoon**, Hunmin Kim, Naira Hovakimyan, Petros Voulgaris. "**Path integral methods with stochastic control barrier functions**," *IEEE Conference on Decision and Control (2022 CDC)*
15. **Hyung-Jin Yoon**, Petros Voulgaris. "**Multi-time Predictions of Wildfire Grid Map using Remote Sensing Local Data**," *IEEE International Conference on Knowledge Graph (2022 ICKG)*

Talks

1. **Learning Human's Physiological Arousal Induced by a Flying Robot**, NSF-FAST Workshop 2017: Machine Learning for Discovery Sciences, Yerevan Armenia.
2. **Regression of Human Physiological Arousal Induced by Flying Robots Using Deep Recurrent Neural Networks**, Coordinated Science Lab Student Conference 2017, University of Illinois at Urbana-Champaign.
3. **Prediction of Distance To Empty for Electric Vehicle**, Korean Society of Automotive Engineers, Annual Congress 2012, Seoul Korea.
4. **Driving Range Development of Small EV**, Society of Automotive Engineers of Japan, Annual Congress 2012, Yokohama Japan.

Poster Sessions

1. **Socially-Aware Path Planning for a Flying Robot in Close Proximity of Humans**, 2018 National Robotics Initiative (NRI) Principal Investigators' Meeting.
2. **Learning Human's Physiological Arousal Induced by a Flying Robot**, Data Science Day 2017, Illinois Data Science Initiative at the University of Illinois at Urbana-Champaign.

Patents

1. US 8896247 B2, **Current sensor reconfiguration method of a vehicle having a motor**.
2. US 8504219 B2, **Telematics device for electric vehicle and remote air-conditioning control method thereof**.

Mentoring Experience

Research Mentor for Undergraduate and Graduate Students at UNR 2020 - Present

- Undergraduate: Alissa Chavalithumrong (pursuing Ph.D degree at MIT)
- Graduate: Antonio Fernández Castaño (ongoing), Kripash Shrestha (SW engineer at Amazon)

Research Mentor for Undergraduate and Graduate Students at UIUC 2018 - Present

- Undergraduate: Huaiyu Chen (M.S degree at UPenn)
- Graduate: Chuyuan Tao (ongoing), Hyungsoo Kang (ongoing)

Computer Skills

1. Machine Learning Tools: Pytorch, Tensorflow.
2. Python: COURSERA certificate (Python for Everybody).
3. MATLAB: Simulink, Stateflow.
4. C and C++: Autonomous vehicle firmware.
5. Unreal and Unity: Game/VR Environment Development

Professional Service

Reviewer for Conferences and Journals

- IEEE Transactions on Automatic Control
- AIAA Journal of Guidance, Control, and Dynamics
- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Robotics and Automation (ICRA)
- American Control Conference
- IEEE Conference on Decision and Control
- Conference on Neural Information Processing Systems
- International Conference on Machine Learning